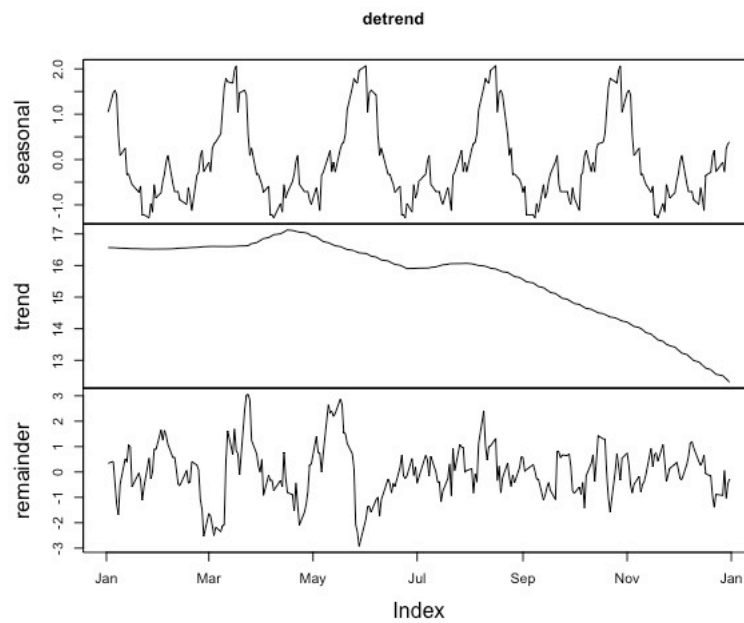
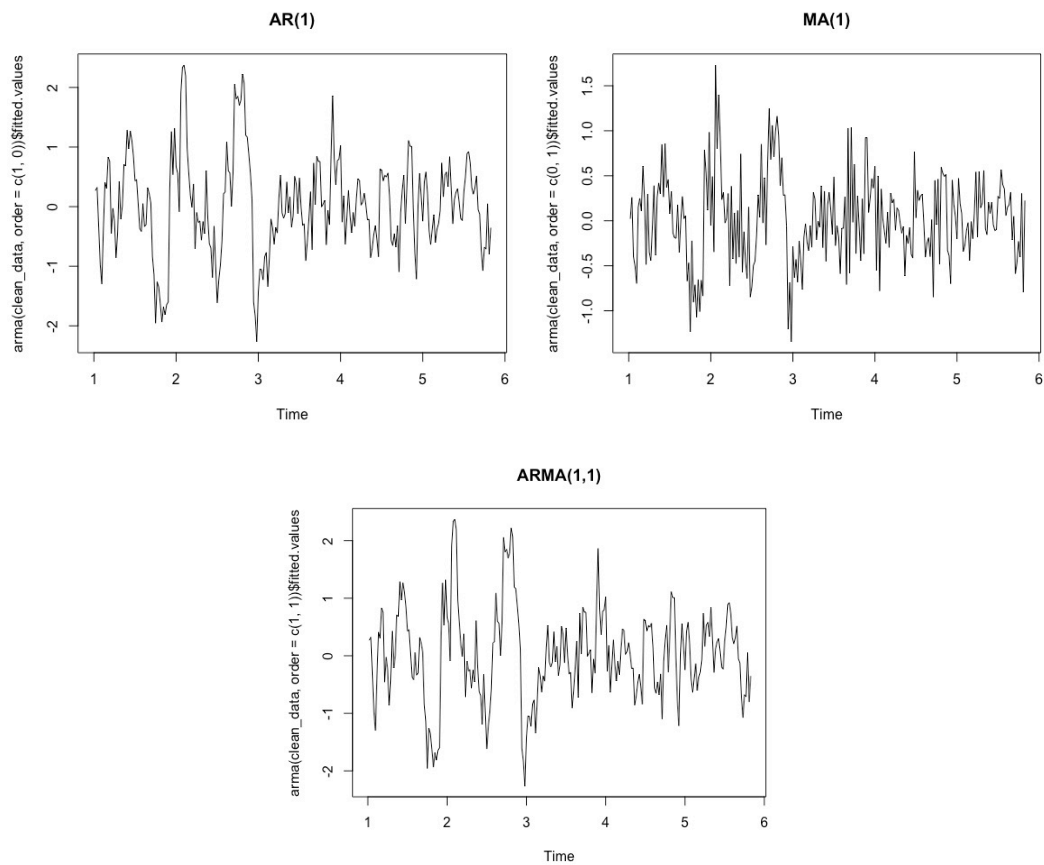


#2.

(a)The detrend plot shows as following:



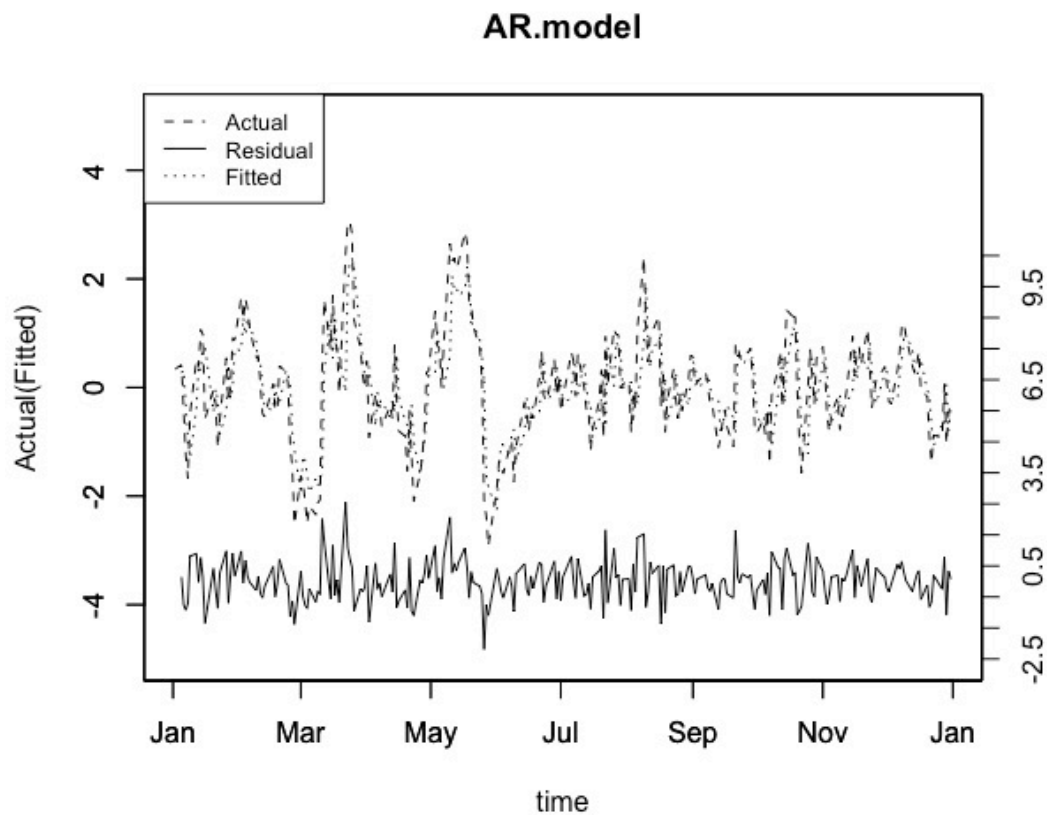
(b)The fitted plot in AR(1), MA(1), ARMA(1) show as followings:



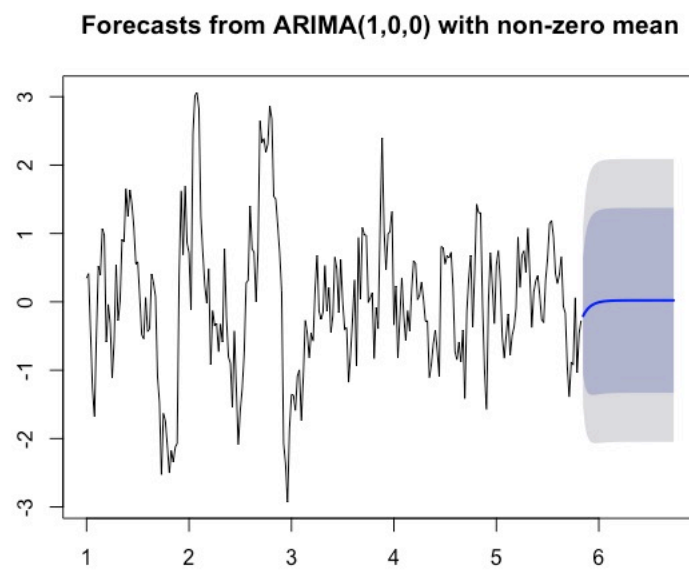
(c) Because of the AIC of three models, I choose to use AR(1)

```
> # results I needed  
> ar.model$aic  
[1] 520.5887  
> ma.model$aic  
[1] 612.6627  
> arma.model$aic  
[1] 522.584
```

And the whole plot is:



(d)The prediction plot shows as following:



Code

```
# Topic: The Homework in Analysis of Time Series

# Name: YANG CHENYU
# Class: Financial Engineering 2
# Student ID:2016301550186

# load package-----
library(tseries)
library(lmtest)
library(tidyverse)
library(zoo)
library(forecast)

# set workspace-----
setwd('/Users/mac/Desktop/R_Time_Analysis/Homework 2')

# input data-----
data = read_csv('VIX1.csv')

# 1-----
sample_data <- filter(data, Date < as.Date('2005-1-1'))
sample_vix <- ts(sample_data$VIX, frequency = 52)
detrend_result <- stl(sample_vix, s.window = 'periodic')
detrend <- zoo(detrend_result$time.series, order.by = sample_data$Date)
clean_data <- detrend_result$time.series[, "remainder"]
plot(detrend)

# 2-----
plot(arma(clean_data, order = c(1,0))$fitted.values, main = 'AR(1)')
plot(arma(clean_data, order = c(0,1))$fitted.values, main = 'MA(1)')
plot(arma(clean_data, order = c(1,1))$fitted.values, main = 'ARMA(1,1)')

ar.model <- arima(clean_data, order = c(1,0,0))
ma.model <- arima(clean_data, order = c(0,0,1))
arma.model <- arima(clean_data, order = c(1,0,1))

# results I needed
ar.model$aic
ma.model$aic
arma.model$aic

actual <- zoo(clean_data, order.by = sample_data$Date)
fitted <- zoo(ar.model$fitted.values, order.by = sample_data$Date)
residual <- zoo(ar.model$residuals, order.by = sample_data$Date)
```

```

plot(actual, type = "l", ylim = c(-5, 5), main = 'AR.model',
      ylab = "Actual(Fitted)", xlab = "time", lty = 2)

par(new = TRUE)
plot(fitted, type = "l", ylim = c(-5, 5),
      ylab = "", xlab = "", lty = 3)

par(new = TRUE)
plot(residual, type = "l", ylim = c(-2.5, 15), ylab = "", xlab = "", lty = 1, axes = FALSE)
axis(side = 4, at = c(seq(-2.5, 10.5, by = 1)), lab = c(seq(-2.5, 10.5, by = 1)),
      ylab = "Residual", xlab = "")

legend("topleft", c("Actual", "Residual", "Fitted"), cex = 0.8, lty = c(2, 1, 3))

# 3-----
summary(ar.model)
forecast_data <- forecast(ar.model, h=47)
plot(forecast_data)

```